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BLASTOIDS FROM THE CUYAHOGA FORMATION OF OHIO (ECHINODERMATA; LOWER MISSISSIPPIAN)

WILLIAM I. AUSICH

Department of Geological Sciences

The Ohio State University

Columbus, Ohio 43210

and

ROBERT L. GUENTHER

149 East Main Street

Shelby, Ohio 44875

ABSTRACT

Blastoid echinoderm fossils are reported for the first time from the Lower Mississippian Cuyahoga Formation of northern Ohio. Although two species are present, poor preservation prevents specific and generic identification. Regardless, this is an important occurrence because few blastoids are known from the Kinderhookian–early Osagean siliciclastic environments represented by the Cuyahoga Formation.

Introduction

Five blastoid specimens, perhaps belonging to two new species, have recently become available from Lower Mississippian strata of northern Ohio. Although a diverse crinoid fauna has been known from the Lower Mississippian Cuyahoga Formation since the monographic works of James Hall (Hall, 1863; Hall and Whitfield, 1875), blastoids have never been reported from these strata.

The precise age of the Cuyahoga Formation has been equivocal, largely because of a lack of biostratigraphically diagnostic fossils. Apparently, it was deposited sometime between the late Kinderhookian and middle Osagean (Szmuc, 1959; Hoare, 1990), and the Kinderhookian-Osagean boundary probably lies within the Cuyahoga. Recently, Carter (1985) indicated that Cuyahoga Formation brachiopods have strong Kinderhookian affinities, but Gordon (1986) reported early Osagean ammonoids in the upper part of the Cuyahoga Formation.

This small, poorly preserved blastoid fauna is significant, regardless of its Early Mississippian age. Relatively few blastoids are known from the late Kinderhookian–early Osagean interval, the more probable age of the Cuyahoga Formation, especially in the midcontinent. So despite the poor preservation, recognition of the presence and facies occurrences of these blastoids is quite important. If these new blastoids are slightly younger, middle Osagean and contemporaneous with the Burlington Limestone, this occurrence would also be significant by demonstrating that both fissiculate and granatocrinid blastoids were present in shallow water siliciclastic environments during the middle Osagean, even though this was not an optimum habitat.

Blastoid abundance and diversity reached its historic high in the Burlington Limestone. Approximately 17 blastoid genera are recognized from the Burlington Limestone, and blastoids are one of the more common fossils in that unit. The Burlington is characteristic of middle Osagean and Early Mississippian blastoids, because they typically are most common in carbonate environments (Waters et al., 1982; Sprinkle and Gutschick, 1990). At the close of the middle Osagean, a major extinction event occurred among blastoids (Ausich et al., 1988). Immediately following that extinction, blastoids were no longer common and diverse in shallow-water carbonate environments such as the Burlington Limestone. Instead, they were better represented in basinal siliciclastic or mixed siliciclastic/carbonate facies such as the New Providence Shale Member of the Borden Formation or the Fort Payne Formation (Ausich et al., 1988; Ausich and Meyer, 1988). Further study of Cuyahoga Formation blastoids from Ohio and other coeval blastoids from siliciclastic facies may reveal the ancestral roots of the late Osagean basinal blastoid faunas. Did the younger blastoids evolve from among the blastoids from carbonate environments such as the Burlington Limestone or from blastoids in siliciclastic environments such as these reported here from the Cuyahoga Formation?

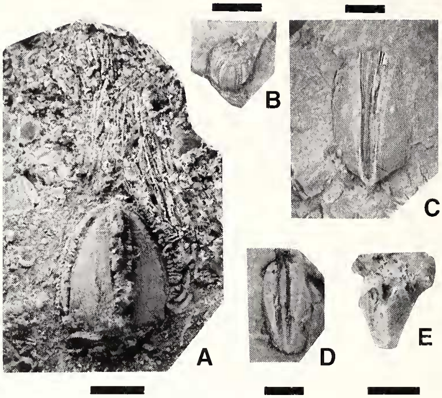

Figure 1. Photographs of Early Mississippian blastoids from Ohio. A-D, granatocrinid gen. and sp. indet.; A, latex mold of a nearly complete specimen in lateral view, note thecal plate sculpturing and brachioles, USNM 483880; B, oblique oral view of partially crushed juvenile questionably assigned to this taxon, CMNH 5854; C, radial plate with ambulacrum in lateral view, CMNH 5942; D, very poorly preserved internal mold of a partial specimen, USNM 483881; E, *Phaenoschisma?* sp., lateral view, note that the base is partially broken away and the ambulacra are absent from the radial sinuses, USNM 483879. All bar scales equal 0.5 cm.

Two of these new blastoid specimens were collected by Guenther, one was found in the collections of the U.S. National Museum of Natural History by Ausich, and two are from The Cleveland Museum of Natural History (collected by G. Meszaros). Search for additional Cuyahoga blastoid material has been unsuccessful.

Terminology follows Beaver (1968), suprageneric classification follows Waters and Horowitz (1993) for granatocrinids and Breimer and Macurda (1972) for fissiculates, and measurements are in mm. Specimens are deposited in the U.S. National Museum of Natural History, Washington, D.C. (USNM), and in The Cleveland Museum of Natural History (CMNH).

Systematic Paleontology

Class Blastoidea Say, 1825
Order Fissiculata Jaekel, 1918
Family Phaenoschismatidae
Etheridge and Carpenter, 1886
Genus *Phaenoschisma* Etheridge and Carpenter, 1882
Phaenoschisma? sp.
Figures 1E, 2A

Description

Theca small, conical in lateral view (Figures 1E, 2A), pelvis with straight sides; vault low; theca pentagonal in oval view, with interradial areas not indented; pelvic angle narrow.

Basals three, less than 50 percent thecal height (Figure 2A); one azygous and two zygous plates, basal-basal and radial-basal sutures straight; basals smooth except for growth lines parallel to radial-basal suture; proximal portion of basal circlet not preserved.

Radials five, forming more than upper half of pelvis, perhaps all of vault; radial-radial sutures straight; radial height exceeds width; interradial area straight; sculpturing smooth except for growth lines (on at least one plate) that parallel radial-basal sutures.

Deltoids not visible in lateral view; deltoid crest apparently sloping slightly downward toward the mouth.

Hydrospire slits apparently extend to abaxial margin of radial sinus (abaxial portions exposed while cleaning the sinus for the ambulacra).

Deltoids, ambulacra, hydrospires, and column unknown.

Material examined

The single specimen assigned to *Phaenoschisma*? sp. is USNM 483879.

Discussion

Specimen USNM 483879 is a partial theca preserved as a cast with an outer coating of siderite (Figure 1E). The proximal portion of the basal circlet is broken away, and the ambulacral areas are not preserved. However, plate surface details are very well preserved and still display fine growth lines (Figure 1E). The theca is small (less than 1.0 cm), is conical in shape, has a pentagonal outline in oral view, and has a vault subordinate in height to the pelvis (Figure 1E).

In general thecal shape, this blastoid appears to be similar to *Hadroblastus*, *Koryschisma*, *Pentremoblastus*, and *Phaenoschisma*. A sufficient number of morphological characters are unknown from this specimen so that positive identification is not possible. However, we can questionably assign specimen USNM 483879 to *Phaenoschisma* sp. by the process of elimination. *Hadroblastus* has wide ambulacral sinuses, a biconical calyx with the vault and pelvis nearly equal in height. *Koryschisma* is commonly larger with a longer vault and a flat deltoid crest. Specimen 483879 has relatively narrow ambulacral sinuses and a short vault in relation to the pelvis. This and the slightly downward sloping deltoid crest align this specimen with *Phaenoschisma* rather than with *Pentremoblastus*. Sprinkle and Gutschick (1990, p. 121-122) also reported an isolated *Phenoschisma*? from the upper Lodgepole Limestone of Montana (lower

Figure 2. Camera lucida drawings of Early Mississippian blastoids. A, *Phaenoschisma*? sp., lower portion of basal circlet broken away, USNM 483879; B, granatocrinid gen. and sp. indet., USNM 483880, blackened oval is the questionable position of a spiracle, only brachiole traces are shown; dashed lines indicate uncertainty in position of plate boundary.

Osagean), but it had a shorter vault and probably a narrower theca than in USNM 483879.

Occurrence

Phaenoschisma? sp. is known from the Meadville Member of the Cuyahoga Formation along the West Fork of the East Branch of Black River. This locality is approximately 4 km (2.5 mi) east of Homerville, Medina County, Ohio. It was preserved in a siderite concretion collected from a silty limestone layer about two feet above the water level and about 4.25 m (14 ft) below the top of the outcrop.

Measurements

USNM 483879: incomplete thecal height, 6.3; maximum thecal width, 5.0; maximum basal circlet width, 2.8; radial plate height, 4.5; maximum radial plate width, 2.9.

Order Granatocrinida Bather, 1900
Family Granatocrinidae Fay, 1961
Granatocrinid gen. and sp indet.
Figures 1A-1D, 2B

Description

Theca medium to large size, subellipsoidal (Figures 1A, 2B); probably slightly higher than wide, widest portion near base of theca; pelvis not known but thecal shape suggestive that it may be a low cone, vault probably majority of thecal height; oral view outline rounded pentagonal; interambulacral areas slightly convex; dominant striated thecal plate sculpturing.

Basals unknown.

Radials undoubtedly five, base of radial probably quite short, limbs long, majority of thecal height (Figures 1A-1C, 2B); in oral view radials gently convex; radial sides slightly wider than ambulacral width proximally, but sides narrow distally; low ridge along the proximal boundary of radial sinus. Three sculpturing fields on each radial limb: in adambulacral-proximal position, irregular sinuous ridges oblique to the radial-radial sutures, this field narrows distally; in abambulacral-proximal position, fine straight ridges that parallel the radial-radial suture, this field expands distally; in adambulacral-distal position, straight coarse ridges perpendicular to radial-radial suture, this field thins proximally (Figures 1A-1C).

Two deltoids preserved, rhombic but nearly triangular in shape, gently convex longitudinally and along width, distal tip below peristome; sculpturing discontinuous, irregular coarse ridges approximately perpendicular to deltoid margin. Anal deltoids unknown.

Ambulacra presumably five, linear, taper in width distally, convex in cross section with groove slightly depressed, probably extend nearly to base of theca, lancet apparently not exposed along ambulacrum.

Spiracles very poorly preserved. Regular spiracles may be ellipsoidal, situated approximately at radial-deltoid suture (Figure 2B).

Brachioles very fine, extend greater than one thecal height above peristome.

Column unknown.

Material examined

Two specimens are assigned to granatocrinid gen. and sp. indet.: USNM 483880 and CMNH 5942. Additionally, two specimens are questionably assigned to this taxon: CMNH 5854 is a juvenile and USNM 483881 is a very, very poorly preserved internal mold.

Discussion

Specimen USNM 483880 is nearly a complete blastoid with brachioles attached (Figures 1A, 2B). However, because it is preserved as an external mold of less than half of the specimen, its identity is problematic. The fidelity of the mold is excellent where present. Specimen CMNH 5942 (Figure 1C) is a partial radial plate. Detail of the plate sculpturing is excellent; and although slight differences occur between it and USNM 483830, these two specimens are considered conspecific. Long, groove-like features are present along the ambulacrum of CMNH 5942 that superficially appear to be hydrospire slits; however, these are judged to be brachioles (complete and weathered). A second specimen from the Cleveland Museum (CMNH 5854; Figure 1B) is very small and regarded as a juvenile. It is preserved in an obliquely crushed oral orientation, and details of the summit are poorly preserved. Again, the unique details of plate sculpturing of other specimens are present on CMNH 5942, but for the present, it should be questionably assigned to this taxon. From this juvenile, the lateral position of the spiracles (Figure 2B) cannot be verified, but the spiracles are not preserved elsewhere. Another questionable specimen (Figure 1D) is a very poorly preserved, compressed specimen (USNM 483881). It is slightly more than 1.0 cm high, and it is a very poor cast in a gray shale. The only evident aspect of this specimen is the presence of long ambulacra, which probably aligns it with granatocrinid gen. and sp. indet.

Placement of the spiracles (Figure 2B) is questionable due to preservation. However, if this lateral position of the spiracles is correct, this species has 8, 9, or 10 spiracles. Specimen CMNH 5854 may have an anispiral. This along with the subellipsoidal thecal shape, relatively short deltoids, and lancets not exposed aligns this species to the Order Granatocrinida and to the Family Granatocrinidae. Because features of the basals, deltoids, and spiracles are unknown, this blastoid cannot be assigned to a genus.

Occurrence

Specimen USNM 483880 was discovered in a drawer at the U.S. National Museum of Natural History. The label accompanying this specimen has the following information "Loose Rx in stream bed Meadville fm. West Branch of Rocky R. at junction of small stream south of Abbyville, Medina Co., Ohio Coll. J.J. Happinger." Although we have been unable to recollect blastoids from this locality, this location is reasonable, and it would also have come from strata in the Meadville Member of Cuyahoga Formation.

Specimen USNM 483881 is from the Cuyahoga Formation (member not differentiated) approximately 3.2 km (2.0 mi) east of Hayesville, Ashland County, Ohio [SW¼, SW¼, SW¼, sec. 18, T21N, R16W]. Siderite concretions are also present in the Cuyahoga at this locality, but this blastoid is from a gray shale layer about 14 feet below the top of exposures at this locality. It was collected about eight inches above water level by Guenther.

Specimens CMNH 5854 and CMNH 5942 are both from the Meadville Member of the Cuyahoga Formation from an unspecified locality at or near Lodi.

Measurements

USNM 483880: incomplete thecal height, 11.8; incomplete thecal width, 9.6; maximum radial plate width, 5.7; deltoid height, 2.2; maximum deltoid width, 1.7. USNM 483881: preserved theca nearly 15 mm high; theca plus brachioles more than 30 mm high.

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References

Ausich, W. I., and D. L. Meyer. 1988. Blastoids from the late Osagean Fort Payne Formation (Kentucky and Tennessee). Journal of Paleontology, 62:269-283.

Ausich, W. I., D. L. Meyer, and J. A. Waters. 1988. Middle Mississippian blastoid extinction event. Science, 240:796-798.

Bather, F. A. 1900. The Echinodermata, The Pelmatozoa, 216 p. *In* E. R. Lankester (ed.), A Treatise on Zoology, pt. 3. London, Adam & Charles Black.

Beaver, H. H. 1968. Morphology, p. S300-S350. *In* R.C. Moore (ed.), Treatise on Invertebrate Paleontology, Pt. S, Echinodermata 1(2). Lawrence, Geological Society of America and University of Kansas Press.

Breimer, A., and D. B. Macurda, Jr. 1972. The phylogeny of the fissiculate blastoids. Verhandelingen der Koninklijke Nederlandse Akademie van Wetenschappen, Afdeling Natuurkunde Eerste Reeks, 2(3), 390 p.

Carter, J. L. 1985. The Lower Mississippian brachiopod genus *Punctothyris* Hyde is not endopunctate. Carnegie Museum of Natural History Annals, 54:375-391.

Etheridge, R., Jr., and P. H. Carpenter. 1882. On certain points in the morphology of the Blastoidea, with descriptions of some new genera and species. Annals and Magazine of Natural History, series 5, 9(52):213-252.

Etheridge, R., Jr., and P. H. Carpenter. 1886. Catalogue of the Blastoidea in the Geological Department of the British Museum (Natural History), with an account of the morphology and systematic position of the group, and a revision of the genera and species. British Museum Catalogue, London, 322 p.

Fay, R. O. 1961. Blastoid studies. University of Kansas Paleontological Contributions, Echinodermata, Article 3, 147 p.

Gordon, M., Jr. 1986. Late Kinderhookian (Early Mississippian) ammonoids of the western United States. Paleontological Society Memoir 19 (Journal of Paleontology, 60(3), supplement), 36 p.

Hall, J. 1863. A preliminary notice of some of the species of Crinoidea from the Waverly sandstone series of Summit Co., Ohio, supposed to be of the age of the Chemung group of New York. New York State Cabinet Natural History 17th Report, p. 50-60.

Hall, J., and R. P. Whitfield. 1875. Descriptions of invertebrate fossils, mainly from the Silurian System, Crinoidea of the Waverly Group. Ohio Geological Survey Report, 2:162-179.

Hoare, R. D. 1990. Mississippian rostroconch mollusks from Ohio. Journal of Paleontology, 64:725-732.

Jaekel, O. 1918. Phylogenie und System der Pelmatozoen. Paläontologische Zeitschrift, 3(1):1-128.

Say, T. 1825. On two genera and several species of Crinoidea. Philadelphia Academy of Natural Sciences Journal, ser. 1, 4:289-296.

Sprinkle, J., and R. C. Gutschick. 1990. Early Mississippian blastoids from western Montana. Museum of Comparative Zoology Bulletin, 152: 89-166.

Szmuc, E. J. 1959. Stratigraphy of the Cuyahoga Formation and Shenango Sandstone of northern Ohio and northwestern Pennsylvania. Geological Society of America Bulletin, 70:1684.

Waters, J. A., and A. S. Horowitz. 1993. Ordinal-level evolution in the Blastoidea. Lethaia, 26:207-213.

Waters, J. A., T. W. Broadhead, and A. S. Horowitz. 1982. The evolution of *Pentremites* (Blastoidea) and Carboniferous crinoid community succession, p. 133-138. *In* J. M. Lawrence (ed.), Echinoderms: Proceedings of the International Conference, Tampa Bay. Rotterdam, A.A. Balkema.